

# Multi-agent Prognostics Health and Usage Monitoring (Multi-PHUM), Phase I

Completed Technology Project (2004 - 2004)



## Project Introduction

A prognostic system needs to separate nominal component behavior from the faulty ones even in the cases when those behaviors are similar. Advanced pattern recognition techniques are required to separate nominal and faulty input-output component data vectors in a complex high-dimensional space. We propose to develop the Multi-agent Prognostic Health and Usage Monitoring (Multi-PHUM) and test it in a subsection of an aerospace vehicle. MULTI-PHUM is hierarchical with the lower levels performing ordinary diagnostics and prognostics using graph-based fault diagnosis technique to place alarms on safety-critical components and handle situations with multiple faults. At the intermediate level of hierarchy, MULTI-PHUM uses neural network techniques such as the Extended Auto Associative Neural Networks (E-AANN) to detect the faults not detected by lower level graph-based method. Yet at a higher level of hierarchy, MULTI-PHUM performs advanced rule-based pattern recognition for abnormalities in the system not detected by lower levels. The essence of MULTI-PHUM is based on the latest tools in the information age and hence has a strong commercial potential for the management of other systems that have to economically maintain healthy fleets such as airline systems with many aircrafts or future swarms of UAVs.

## Anticipated Benefits

Potential NASA Commercial Applications: The current Original Equipment Manufacturing companies (OEMs) suffer significantly from disconnects that exist between the equipment designers, manufacturers, and equipment testers. IIS Corp plans to aggressively commercialize the results of this SBIR work by developing alignments with companies that are involved in providing software support to OEMs. In particular, we will team up with Sigma Quest Inc. of Santa Clara in commercializing the results of this SBIR to OEM companies such as Selectrons.



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Ames Research Center (ARC)

### Responsible Program:

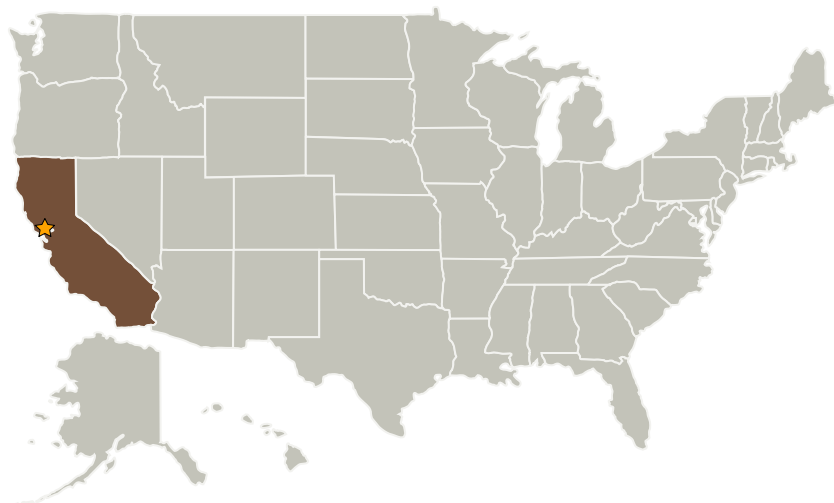
Small Business Innovation Research/Small Business Tech Transfer

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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
Intelligent Inference Systems Corp	Supporting Organization	Industry	Moffett Field, California

## Primary U.S. Work Locations

California

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Principal Investigator:

Hamid Berenji

## Technology Areas

### Primary:

- TX10 Autonomous Systems
  - ↳ TX10.2 Reasoning and Acting
    - ↳ TX10.2.5 Fault Diagnosis and Prognosis